

Soil Compactor with Power Steering

This invention pertains to a soil compaction device according to the preamble of patent claim 1.

Soil compaction devices of this type, for example a vibration plate with the type designation "Wacker DPU 7060", are well known and have proven themselves in practice to be excellent, especially in compacting mainly coarse-grained or weakly agglomerating soils. Here, an oscillator driven by a motor is attached to a soil contact plate and sets the soil contact plate into vertical oscillation which then is transferred to the soil. The oscillation produced usually has a constant or even a variable horizontal force component that provides a forward, backward or steering motion of the vibration plate. In the process, the horizontal motion of the vibration plate is supported by the operator through a center guide post or a guide handle.

At the center guide post, an operating lever can be provided that is coupled to hydraulic valves, with the help of which the direction of motion of the vibration plate can be adjusted using a hydraulic positioning system. Another known method is to perform the steering and direction functions using a remote control unit. In these remote controlled plates, the steering is commonly done by providing the oscillator with separate eccentric weights that are adjusted so as to work against one another and produce a circular or yawing motion of the machine.

Even with remote controlled vibration plates, the operator can always manually control the motion or steering process by pulling on the guide handle. The operator must press buttons on the remote control and at the same time pull buttons on the guide handle. This requires a large amount of force since the guide handle of remote controlled machines is much shorter than the center guide posts of non remote-controlled machines. Since the operator must simultaneously activate other operator elements der control such as control sticks, pushbuttons or the like, he can only hold the guide handle with one hand. This type of operation is very strenuous for the operator and thus is not beneficial to work progress.

The objective of this invention is to provide a soil compaction device that is easy for the operator to manually steer even when it is equipped with a remote control unit or with pushbuttons on an operator panel.

- Ans A37
- 5 This objective is met according to the invention by a soil compaction device with the features of patent claim 1. Advantageous developments of the invention are found in the dependent claims.

10 This invention is characterized in that a sensor unit is provided to determine the position of at least one operator element. This sensor produces a signal to control a positioning unit for the oscillator. This makes it possible for the operator to activate the positioning unit through the operator element without the need to provide additional cost-intensive and maintenance-intensive hydraulic valves at the operator element – as is the state of the technology.

- 15 In an especially advantageous development of the invention, the operator element and the sensor unit are attached to a guide handle of the soil compaction device. When the operator now activates the moving operator element, without the expenditure of large amounts of force, and thus moves it from an initial position, the change in position is detected by the sensor unit and a corresponding signal is sent to the positioning unit. In a known fashion, the  
20 positioning unit changes the position or phase of the rotating eccentric masses with respect to one another, whereupon the horizontal component of the resultant overall force changes and a change in the directional behavior of the vibration plate is produced.

- 25 Suitable operator elements include – depending on the equipment of the vibration plate – one or two handles that are moveable together or separately. Furthermore, the operator element can also be designed in the form of a “joystick”.

- 30 It is especially advantageous if the invention is used in vibration plates with remote control wherein the device itself has only pushbuttons – if it has any at all – for the direct actuation of hydraulic valves of the hydraulic positioning unit at it has only a short guide handle. Having an additional moving operator element with a sensor unit ensures that the operator

can comfortably guide the vibration plate in the same way as a vibration plate without remote control.

5 This and other features and advantages of the invention are explained in more detail below using an example and with the help of the accompanying figures.

Shown are:

Fig. 1 a schematic side view of a soil compaction device according to the invention:

Fig. 2 a top view of the soil compaction device, and

Fig. 3 a schematic sectional enlargement of the operator area of Fig. 2.

15 Fig. 1 shows a soil compaction device according to the invention in a schematic side view in the form of a vibration plate whose basic design is known and is only briefly depicted below.

A motor, not shown, drives two shafts 1, 2 in opposite directions through a drive unit in the direction of the arrow in Fig. 1. Each shaft has an eccentric mass, 3, 4, respectively, on it.

20 The rotation of the eccentric masses produces an essentially vertically directed oscillation that is transferred to the soil to be compacted by means of a soil contact plate 5.

25 The shafts 1, 2 as well as the eccentric masses 3, 4 can each be separated in the axial direction so as to produce a yawing moment – at the right phase relationship – which makes the vibration plate rotate at a point or – with simultaneous forward motion – travel about a curved radius.

30 The change of the phase relationship of the shafts 1, 2 to one another as well as the phase relationship of two eccentric masses on one shaft is done using a known positioning unit in which suitable control elements, not shown, are shifted by means of a hydraulic system 6, which is also a part of the positioning unit.

The fluid stream in the hydraulic system 6 can be influenced in various ways according to the state of the technology:

5 There are vibration plates known with a control handle 8 at the end of a center guide post 7 or guide handle 7 serving as an operator element. This control handle tilts at the end of the center guide post 7 and directly activates a hydraulic valve belonging to the hydraulic system 6.

10 In a remote-controlled vibration plate, a receiver unit 9 is provided at the vibration plate that receives radio or infrared signals from a sending unit, not shown. It is also common to receive electrical signals over a cable remote control unit. The signals are converted in the receiver unit 9 and actuate electromagnetic valves provided in the hydraulic system 6 through a hydraulic system controller 10.

15 These types of remote-controlled vibration plates primarily have the center guide post 7 designed as a short guide handle. Moreover, there are often no additional operator elements provided on the vibration plate itself since the operation is to be done through the sending unit only. For cable remote control systems, however, vibration plates are known in which the sending unit can be inserted into a corresponding receptacle in the vibration plate and  
20 then be used as an operator panel.

In manually correcting the motion of the vibration plate, the operator must pull the short guide handle with one hand and at the same time activate the remote control or suitable pushbuttons on the operator panel with the other hand in order to attain the desired motion of  
25 the vibration plate.

In order to make this easier for the operator, an additional moving control handle 8 is provided on the short guide handle 7 whose change in position does not directly cause a change in the position of a hydraulic valve, but rather is detected by a sensor unit 11 that is  
30 likewise located at the end of the guide handle 7.

The sensor unit 11 can be constructed in the form of a Hall generator, a proximity switch or can be built of reed contacts. It converts the respective position of the control handle 8 into

an electrical signal that is fed to the hydraulic system controller 10. As sensors for the sensor unit 11, capacitive, inductive and resistive sensors are suitable and must be located near the control handle 8.

5 In the hydraulic system controller 10, the signal is electromechanically converted, for example by means of an electromagnetic control element that acts on the hydraulic system 6 and thus influences the phase relationship of the shafts 1, 2, and the eccentric weights 3, 4 in the oscillator.

10 The steering of the vibration plate is thus accomplished through a type of servo control.

Figures 2 and 3 show a schematic top view of the vibration plate according to the invention, wherein Fig. 3 is a sectional enlargement of Fig. 2.

15 At the end of the center guide post 7, there are two control handles 8 serving as operator elements where the operator can guide the machine. Each of the control handles 8 can be rotated relative to the center guide post 7 resulting in the motion or steering behavior of the vibration plate changing. Instead of the center guide post 7, the control handle 8 can also be located on a shorter guide handle.

20 Each control handle 8 is inserted into the sensor unit 11 and has a transmitting magnet 12 at its end that is opposite a Hall sensor 13. Through the motion of the transmitting magnet 12 at the hall sensors 13, an electrical voltage is produced that is fed as a signal through a line 14 to the hydraulic controller 10.

25 To dampen the oscillation of the control handle 8, a rubber element 15 can be attached in the form of a collar.

30 Instead of the Hall sensor 13 described, other sensor units are also possible, for example proximity switches, reed contacts, etc.

If, as shown in Fig. 2, two independently moving control handles 8 are provided, not only can the direction of travel (forward, backward, standstill) of the vibration plate be adjusted, but

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also a steering or circular motion can be accomplished, provide the oscillator is so equipped.

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- 5 The control handle 8 can moreover be acted upon by a spring, not shown, in order to be held in a zero position when it is not activated so that the vibration plate always falls back into a safe state in its zero position. In this state, it makes no motion of its own outside of its vertical oscillatory motion. In the zero position, the horizontal forces produced by the eccentric weights neutralize each other such that the resulting overall force has no horizontal component.

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